TITLE OF THE INVENTION

Twin-Wire Former

CROSS REFERENCES TO RELATED APPLICATIONS

[0001] This application claims priority on Finnish Patent Application No. 20010129, Filed January 22, 2001, the disclosure of which is incorporated by reference herein.

STATEMENT AS TO RIGHTS TO INVENTIONS MADE UNDER FEDERALLY SPONSORED RESEARCH AND DEVELOPMENT

Not applicable.

BACKGROUND OF THE INVENTION

[0002] The invention relates to a twin-wire former in a paper machine, which former includes two forming wire loops defining between themselves a twin-wire zone, and at least one dewatering box located inside one of the wire loops to remove water through said wire from the web being formed, and at least one loading blade

located opposite to the dewatering box inside the other wire loop and in contact with said wire, said dewatering box including at least three successive dewatering zones.

[0003] In a gap former of a paper machine, a pulp suspension is fed into a forming gap between two forming wires, which wires are guided to curve over a forming roll and/or a forming shoe, which is equipped with a curved blade deck. In the narrowing gap, water is removed from the pulp suspension, among other things, by the action of a pressure caused by the tension of the wires, on the one hand, through the outer wire boosted by the centrifugal force and, on the other hand, through the inner wire boosted by the suction acting in the forming roll or shoe.

[0004] In the twin-wire zone after the forming gap, various kinds of web forming and dewatering elements are used, the purpose of which is to bring about pressure pulsation in the fibre layer being formed in order to promote dewatering of the web being formed and to improve its formation at the same time. *US Patent Publication 5,798,024* describes a state-of-the-art gap former in which a forming shoe and a loading blade unit function as dewatering and web forming elements after a forming roll. The blade deck of the forming shoe may be straight or curved. The loading blade unit includes a dewatering box provided with dewatering blades and a set of blade elements the loading of which can be controlled and which are placed inside opposite wire loops and in alternating positions with respect to one another so that the pressure pulses applied to the web by the dewatering blades and the loading blades alternate in the running direction of the web. The dewatering achieved by the loading blade unit is boosted by arranging a vacuum at at least one blade set and, preferably, at both blade sets.

[0005] The formation of the paper produced is improved by using a loading blade unit but, at the same time, it increases the porosity of paper, sometimes even to a harmful degree. Especially when making fine paper, high porosity may be a property which is attempted to be avoided. For this reason, loading blade units are not generally used when making paper grades containing highly beaten pulp and an

abundance of filler. It has been found that in such cases it is preferable to use, for example, a forming shoe as the dewatering element, because it brings about lower pressure pulses in the fibre layer and affects the porosity of paper considerably less than a loading blade unit.

[0006] An aim of the invention is to reduce the above-noted problems associated with the prior art. A particular aim is to provide a novel twin-wire former by means of which efficient dewatering is achieved even at high running speeds and which makes it possible to produce paper having uniform formation and suitable porosity.

SUMMARY OF THE INVENTION

[0007] The twin-wire former according to the invention includes one or more dewatering boxes by means of which vacuum zones and vacuum-free zones are arranged in the web forming and dewatering zone, which zones alternate in the running direction of the web. One or more loading blades are arranged inside the wire loop situated opposite to the dewatering box, the loading blades being disposed such that opposite to each loading blade on the opposite side of the web there is a vacuum-free zone, which is preceded and followed by a vacuum zone. Since the vacuum zones and the loading blades are arranged to alternate in the running direction of the web in the proposed manner, the vacuum boosting dewatering and the loading blade producing a pressure pulse will never simultaneously affect the web that is being formed.

[0008] Alternation of the vacuum zones and vacuum-free zones is provided, for example, by dividing one continuous dewatering box with partitions into compartments which form several successive dewatering zones. Of these zones, every second zone is connected to a vacuum source in order to make dewatering more effective, and from every second zone water is removed mechanically without any significant vacuum.

[0009] Different vacuums can be advantageously arranged in the different vacuum

zones so that the vacuum may be increased in the running direction of the web as the solids content of the web increases and dewatering becomes more difficult.

[0010] The number of loading blades and vacuum zones may vary in different applications. What is essential is that opposite to the loading blade there is always a vacuum-free zone, which is preceded and followed by a vacuum zone. In addition to this, the twin-wire former may include a pre-loading blade which precedes the dewatering box proper and which is also most advantageously placed at a location where it is opposed by a zone working without vacuum.

[0011] The invention combines characteristic features of known dewatering elements in a totally new way, so that by means of the new twin-wire former it is possible to simultaneously achieve good formation produced by the loading blades and moderate paper porosity produced by the suction forming shoe.

[0012] In the following, the invention will be described in greater detail with reference to the figures shown in the appended drawings, but the invention is not meant to be exclusively limited to the details of the figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] Figure 1 shows a roll gap former in which vacuum zones and vacuum-free zones alternate, and at the latter zones the web is loaded with the aid of loading blades.

[0014] Figure 2 shows an arrangement similar to that of Fig. 1, in which the surface of the dewatering box in contact with the wire is curved.

[0015] Figure 3 shows a blade gap former.

[0016] Figure 4 shows a modification of the former shown in Fig. 1.

[0017] Figure 5 shows another modification of the former shown in Fig. 1.

[0018] Figure 6 shows an arrangement with a minimum number of loading blades and vacuum zones.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] The twin-wire former shown in Fig. 1 includes a first forming wire loop 10, the running of which is guided by a first forming roll 11 and by guide rolls 12, 12b, and a second forming wire loop 20, the running of which is guided by guide rolls 21, 21a and by a second forming roll 22. A pulp suspension is fed from a headbox 9 into a forming gap, which is defined by the first forming roll 11 on the side of the first wire 10 and by a breast roll 21a on the side of the second wire 20. The joint run of the wires 10 and 20 extends substantially in the vertical direction from a suction sector 11a of the first forming roll 11 all the way to a suction sector 22a of the second forming roll 22, after which the first wire 10 is guided by a guide roll 12b to separate from a web W, which will run with the second wire 20.

[0020] In the twin-wire zone, that is, in the joint run of the wires 10, 20, there is, in addition to the above-mentioned forming rolls 11, 22, also a set of dewatering elements, of which a dewatering box 30 is located inside the first wire loop 10 immediately after the first forming roll 11, and a suction box 42 is located inside the second wire loop 20 immediately before the second forming roll 22. In addition, in the area of the dewatering zone there are a pre-loading blade 41, which is located inside the second wire loop 20 opposite to the area remaining between the forming roll 11 and the dewatering box 30, and loadable blade elements 40, which are located inside the second wire loop 20 opposite to the dewatering box 30.

[0021] On the surface of the dewatering box 30 in contact with the wire 10 there are dewatering blades 34 extending in the cross direction across the web and controlling the running of the wire, and between which dewatering blades water is removed from the web W in the direction of the dewatering box 30. The internal

space of the dewatering box 30 is divided by partitions 33 into five successive zones 30a, 30b, of which three are connected to a vacuum source while a substantially normal pressure prevails in two. The vacuum zones 30a and the vacuum-free zones 30b alternate in the running direction of the web in such a way that each vacuum-free zone 30b is preceded and followed by a vacuum zone 30a. When required, different vacuums p_1, p_2, p_3 can be arranged in the different vacuum zones 30a. The vacuums are preferably arranged to increase in the running direction of the web ($p_1 < p_2 < p_3$). Water drained through the wire 10 is also guided away through the vacuum-free zones 30b, which dewatering is boosted by the pressure pulses applied to the web by the dewatering blades 34 and the loading blades 40 alternately.

[0022] At the dewatering box 30 inside the second wire loop 20 there are two loadable blade elements 40 which extend in the cross direction across the web supporting and loading the wire 20 and doctoring water from its surface. The loading blades 40 also produce pressure pulses in the web W being formed, in consequence of which dewatering becomes more effective and the formation of the web is improved. The loading blades 40 are placed, in a manner known in itself, in alternating positions with the dewatering blades 34 of the deck of the dewatering box 30. In the arrangement according to the invention, the loading blades 40 are placed specifically in those spaces between the dewatering blades 34 in which there is a vacuum-free zone 30b on the side of the dewatering box 30. In that connection, the suction effect applied by the vacuum zones 30a on the web and the pressure pulse applied by the loading blades 40 to the web alternate in the running direction of the web and they never occur at the same time.

[0023] Fig. 2 shows a twin-wire former similar to the one shown in Fig. 1, in which the dewatering blades 34 are arranged to curve the wires 10, 20 while these travel over the dewatering box 30. This increases the pressure applied by the wires 10, 20 to the web and thus improves the efficiency of dewatering. The vacuum zones 30a and the vacuum-free zones 30b are arranged to alternate in the running direction of the web, and the loading blades 40 are located opposite to the vacuum-

free zones 30b.

[0024] Fig. 3 shows a blade gap former in which in the forming gap area the running of the wires 10, 20 is guided by two breast rolls 12a and 21a and by a suction forming shoe 35 having a curved surface. After the forming shoe 35, a dewatering box 30 is located inside the first wire loop 10, opposite to a set of loading blades 40 located inside the second wire loop 20. The dewatering box 30 is divided by partitions 33 into sections in such a way that a total of four vacuum zones 30a and three vacuum-free zones 30b is formed, which zones alternate in the running direction of the web W. Three loading blades 40 are located inside the second wire loop 20, each one opposite to a vacuum-free zone 30b.

[0025] Fig. 4 shows a roll gap former whose dewatering box 30 includes five vacuum zones 30a and four vacuum-free zones 30b, four loading blades 40 being placed opposite to the vacuum-free zones inside the second wire loop 20.

[0026] In the roll gap former shown in Fig. 5, the first zone 31 of a dewatering box 30 after a forming roll 11 is vacuum-free, and opposite to it there is a pre-loading blade 41 inside the second wire loop 20. After the first zone 31 there are three further vacuum zones 30a and two vacuum-free zones 30b, and opposite to the vacuum-free zones there are two loading blades 40 on the side of the second wire loop 20.

[0027] In the example shown in Fig. 6 there is only one loading blade 40 and it is located opposite to a vacuum-free zone 30b remaining between two vacuum zones 30a. The dewatering box 30 is followed further by a suction box 42 placed before the second forming roll 22. The loading blade 40 is located in the same wire loop 10 as the first forming roll 11, and the vacuum box 30 is located in the opposite wire loop 20 before the second forming roll 22.

[0028] Above, the invention has been described with reference to a few examples

only. However, the invention is not intended to be limited to these examples only, but many other modifications of the invention are also possible with the scope defined by the appended claims.